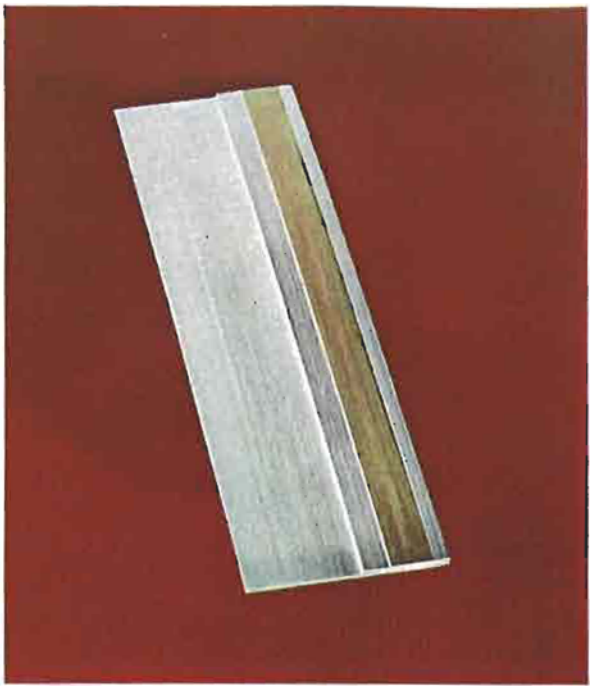

Fig. 5 Many types of connectors incorporate two or more thicknesses of metal in their cross section. The development of profiled bi-metal strip makes it possible to manufacture such parts in a single press operation. This is only one example of a range of profiled strips being produced by Johnson Matthey Metals and comprises an inlay of 10 per cent copper-20 per cent silver-gold in nickel silver

thicknesses of material that make up the backing for the contact. One object of such designs is to provide a flexible spring arm that is supported by, or merely attached to, a stouter terminal end. By using profiled strips such parts can be manufactured in one piece, eliminating joints or the need to deform the metal to produce the thinner section or sections.

All the various combinations of inlaid contact bi-metals described earlier can be obtained in the form of profiled strips. In producing profiled sections one starts with normal bi-metal strip and merely removes metal that is excess to requirement. By this means an abundant variety of inlaid bi-metal profiled strips can be produced, one of which is illustrated in Fig. 5.

Profiled strips are already being used to produce connectors, but the full scope of the process and its potential for creators of new connector designs has yet to be exploited.

Conclusion

The object of this paper has been to present a brief review of the forms in which gold contact materials are available and are being used for the production of connectors, and thereby to stimulate designers and manufacturers to fresh ideas. The varieties of gold contact forms are numerous and it may be possible to detect from this survey the possibility of an immediate cost reduction on an established connector, especially where an economic substitution can be made with little or no inconvenience or modification to the established manufacturing process and tooling.

However, the time to consider all these possible permutations is long before production has been commissioned. That is the time to take advice on what specifically is available, and to juggle with the alternatives. Only in this way can one arrive at the best economic choice that will match the design, the fabrication and the performance of a connector.

The Durability of Plated Electrical Contacts

DIFFUSION OF SUBSTRATE COPPER INTO GOLD DEPOSITS

The use of gold-plated copper in electrical contacts is well established but there have recently been trends towards thinner plating and subsequent operation at higher temperatures than in the past. There has been a consequent tendency for copper to diffuse to the surface of the gold, where it becomes oxidised and forms an insulating film which interferes with good contact. A method of assessing the life of gold-plated contacts affected by this mechanism would therefore be a useful guide to service behaviour.

M. R. Pinnel and J. E. Bennett of Bell Laboratories, Columbus, Ohio have now reported studies leading to such a method for temperatures below 250°C at the Holm Seminar on Electric Contact Phenomena held in Chicago during October 1971. Diffusion rates were measured for 2.5, 25 and 100μ gold plating on polycrystalline copper during annealings at temperatures between 50 and 750°C. Chemical interdiffusion coefficients were found to deviate from predicted values below 250°C. They were significantly greater below 150°C. There was no correlation between plating thickness and diffusion rate.

These diffusion coefficients can be used to estimate the time at each temperature which it takes before degradation of the electroplated gold surface occurs by mass diffusion of the copper substrate. Studies with 1 and 2.5μ gold layers during degradation to 0.1 and 1 per cent surface copper concentrations show, for example, that at 65°C it takes as long as seven years for the surface copper concentration of a 2.5μ gold layer to reach 0.1 atomic per cent and twelve years to reach the 1 atomic per cent level.